

**CERAMIC MATERIALS FOR CAPACITORS WITH A HIGH  
DIELECTRIC CONSTANT AND A LOW CAPACITANCE  
CHANGE WITH TEMPERATURE**

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**ABSTRACT OF THE INVENTION**

The present invention discloses low-cost ceramic powders prepared by the conventional ceramic processing with ceramic raw materials comprising carbonates, oxides and/or hydroxides of barium (Ba), titanium (Ti), magnesium (Mg) and optionally strontium (Sr), lanthanum (La) and niobium (Nb), and lead titanate ( $\text{PbTiO}_3$ ) and/or lead oxide ( $\text{PbO}$ ). The present invention also discloses a ceramic material obtained by the ceramic powder through densification and reduction-reoxidation, which has a dielectric constant of about 20,000 to about 55,000, a dielectric loss tangent ( $\tan \delta$ ) of about 0.05 to about 0.25, a low capacitance change with temperature (low TCC) of about -15% to about 10% at a temperature range of  $-55^\circ\text{C}$  to  $150^\circ\text{C}$ , a resistivity of about  $10^6 \Omega\cdot\text{cm}$  to about  $10^9 \Omega\cdot\text{cm}$ , and a small grain size of about 0.5 to about  $3.5 \mu\text{m}$ . The ceramic materials are useful in the production of capacitors or modules having high performance such as high dielectric constants and low TCC values with low cost. The ceramic powder also can mix with a glass component of low melting temperature to form a low temperature co-fired capacitor.